REMARKS

Claim Amendment

Claims 5, 9, 15 and 19 are amended in a manner believed to obviate any objections raised to the claims on the basis of informalities identified by the Examiner. No claims are cancelled or withdrawn. Upon entry of the amendment claims 1-21 are presented for consideration by the Examiner.

Information Disclosure Statement

The Examiner objects to Applicant's Information Disclosure Statement filed June 24, 2004 as failing to comply with 37 C.F.R. 1.98 paragraph (a)(2). The Examiner is not specific as to which of the required enclosures were not included in the Information Disclosure Statement. Relevant sections of 37 C.F.R. pertaining to Disclosure Information Statements were amended so that Information Disclosure Statements associated with applications having a filing date later than June 30, 2003 need not enclose copies of United States patent references. It is the Applicant's understanding that the listed United States patents need not be provided in paper form due to the changes to the relevant regulations. Applicant encloses herewith copies of publications listed in the Information Disclosure Statement filed June 22, 2004. The Examiner is requested to inform the undersigned of any further requirements.

Claim Rejections – 35 USC § 102

Claims 1-13 and 15-21 are rejected under 35 USC § 102(b) as being anticipated by U.S. Patent No. 2,223,871 to Johnson (hereafter Johnson).

Claim 1 recites as follows:

1. (original) A pin for insertion in a hole in a host material, comprising:

> an elongated cylindrical body constructed from a substantially homogeneous material, said body having a longitudinal axis and a formed portion providing a retaining surface that engages an inside surface of the hole;
>
> said retaining surface defined by a plurality of helical lands having a width separated by a plurality of helical grooves of approximately equal width, said lands being at least partially formed from pin material displaced from said grooves,
>
> wherein at least a portion of each land includes a cylindrical surface parallel to said longitudinal axis at a substantially uniform radial distance from said longitudinal axis.

Claim 1 specifies "an elongated cylindrical body" and "wherein at least a portion of each land includes a cylindrical surface parallel to said longitudinal axis at a substantially uniform radial distance from said longitudinal axis." In contrast, Johnson discloses two embodiments of a tapered pin 12. Johnson describes a process by which cylindrical stock 11 is configured as a blank 10, 20 which is then further formed into the disclosed tapered pin 12 (as shown in Figures 4 and 8). Johnson clearly describes the items of Figure 2 and Figure 6 as "blanks" which illustrate an intermediate manufacturing stage of the disclosed taper pins. The taper pins of Johnson clearly do not include the recited "elongated cylindrical body" or " retaining surface defined by a plurality of helical lands" "wherein at least a portion of each land includes a cylindrical surface parallel to said longitudinal axis at a substantially uniform radial distance from said longitudinal axis." The only pin disclosed in Johnson that includes helical land surfaces is clearly illustrated as a taper pin as shown in Figure 8.

Claim 1 further requires "a plurality of helical grooves of approximately equal width." The taper configuration of the pin illustrated in the configuration of Johnson causes the width of the helical grooves to become smaller and almost disappear at the narrower end of the tapered pin as shown in the enclosed enlarged Figure 8.

Johnson does not disclose, teach or suggest the configurations required by the language of claim 1. Claim 1 is not anticipated or obvious in view of Johnson.

Claims 2-9 depend directly or indirectly from claim 1 and are patentable over Johnson for all the reasons stated in support of claim 1.

Claim 2 requires that "wherein said lands are oriented at an angle of approximately 45° relative to said longitudinal axis." Johnson clearly discloses a pin having helical grooves oriented at an angle of 30°. (see the attached annotated Figure from Johnson) No one of skill in the art would interpret the language "oriented at an angle of approximately 45° relative to said longitudinal axis" of claim 2 as being anticipated by the 30° disclosure of Johnson. Claim 2 is not anticipated or obvious in view of Johnson for at least this reason.

Claim 4 recites "wherein said second diameter is no greater than approximately 9% larger than said first diameter." The Examiner asserts that Johnson "discloses a pin 10 wherein the second diameter is no greater than approximately 9% larger than the first diameter (Figure 9)." As previously discussed, item 10 in Johnson is a blank. Item 12 in Johnson is a pin. Johnson does not disclose, teach or suggest any relationship between the raised portions of the taper pin and the diameter of the cylindrical stock 11 from which the taper pin 12 is formed. Further, MPEP § 2125 states that "proportions of features in a drawing are not evidence of actual proportions when drawings are not to scale." Johnson gives no indication that the drawings are to scale and thus there is no way to assess the relationship between the diameter of the smooth round wire 11 shown in Figure 1 to the lands on the taper pin shown in Figure 8. Claim 4 is not anticipated or obvious in view of Johnson for at least these reasons.

Claim 5 requires that "said helical grooves and lands are oriented at an angle of approximately 45° relative to an axis of said pin." As discussed with respect to claim 2, Johnson discloses grooves and lands oriented at an angle of 30° relative to a longitudinal axis of the pin. Johnson does not disclose, teach or suggest an alternative orientation of grooves and lands relative to the axis of a pin. Claim 5 is not anticipated or obvious in view of Johnson for at least this additional reason.

Claim 6 requires "wherein said lands have a surface area that is at least approximately 40% of a surface area of said formed portion. Since the drawings of Johnson are not indicated to be dimensional drawings, there is no way to assess from Johnson the proportions of the surface area of the lands with respect to the entire surface area of the formed portion. Such a calculation based on the disclosure of Johnson is further complicated by the fact that Johnson discloses a taped pin in which the surface area of each land varies along the length of the pin because the area taken up by the grooves is reduced toward the narrow end of the pin (see enlarged Figure 8). Johnson does not provide adequate support for the Examiner's finding of the limitations of claim 6. Claim 6 is patentable over Johnson for at least this additional reason.

Claim 7 recites "wherein a majority of each of said lands has a substantially uniform height extending above said first diameter and the width of said land is at least approximately five times said height." The Examiner again relies on the drawings of Johnson to anticipate the specific limitations of claim 7. The drawings of Johnson are not dimensional drawings and cannot be used to support the rejection of specific dimensional limitations in a claim. See MPEP § 2125. Even assuming that Johnson could be relied upon, measurement of the dimensions between the lines indicated in the Examiner's enlarged version of Figure 9 of Johnson on page 4 of the Examiner's Office Action reveal a width W of about 15mm and a height H of about 5mm. This results in a width to height ratio of 3 to 1, which does not anticipate or suggest the Applicant's claimed ratio of "at least approximately five times". Johnson does not disclose, teach or suggest the specific limitations of claim 7. Claim 7 is patentable over Johnson for at least this additional reason.

Claim 8 recites, "wherein a majority of each of said lands has a substantially uniform height extending above said first diameter and the width of said land is between five and fifteen times said height." As discussed with respect to claim 7, Johnson does not disclose, teach or suggest the recited specific limitations of claim 8. Claim 8 is patentable for at least this additional reason.

Claim 9 recites "wherein a majority of each said land is a substantially cylindrical surface parallel to and having a substantially uniform radial displacement from the longitudinal axis." Johnson discloses tapered pins where the land surfaces are not cylindrical and in which no portion is a "substantially cylindrical surface parallel to and having a substantially uniform radial displacement from the longitudinal axis" as recited in claim 9. Claim 9 is not anticipated nor obvious in view of Johnson for at least this reason.

Claim 10 recites:

> A pin and substrate combination comprising:
>
> a substrate having a first hardness and defining a hole having a first diameter; and
>
> a pin for insertion into said hole, said pin having a second hardness less than said first hardness and a retaining surface at a second diameter larger than said first diameter, said retaining surface defined by a plurality of lands having a width separated by a plurality of grooves of approximately equal width,
>
> wherein at least a portion of each land includes a cylindrical surface parallel to said longitudinal axis at a substantially uniform radial distance from said longitudinal axis.

Claim 10 recites "a substrate having a first hardness" and "said pin having a second hardness less than said first hardness." Johnson does not disclose, teach or suggest the relative hardnesses of a pin and a host. Johnson teaches at column 2, lines 49-51 that "the grooves are retained to cause the edges of these grooves to grip the metal [of the substrate] and hold the pin in position so it is not likely to vibrate loose or fall out by the release of it's grip." This teaching of Johnson implies that the edges of the tapered pin of Johnson will bite into the host material which will require the pin of Johnson to be harder than the host material rather than the reverse as recited in claim 10. Further, claim 10 requires "wherein at least a portion of each said land includes a cylindrical surface parallel to said longitudinal axis at a substantial radial distance from said longitudinal axis." Johnson teaches only tapered pins and therefore cannot

anticipate or suggest the recitations of claim 10. Claim 10 is patentable over Johnson for at least the foregoing reasons.

Claims 11-20 depend directly or indirectly from claim 10 and are patentable over Johnson for at least the reasons stated in support of claim 10.

Claim 11 recites "wherein said second diameter is no more than approximately 4% larger than said first diameter." The drawings of Johnson are not dimensional and cannot be relied upon to anticipate or suggest specific dimensional limitations recited in Applicant's claims. See MPEP § 2125. Johnson does not disclose, teach or suggest the specific relationship between the diameter of a whole and a host material and the diameter of the retaining surface of a pin as recited in claim 11. Claim 11 is additionally patentable over Johnson for at least this reason.

Claim 13 recites "wherein said lands and grooves are helical and have an angle of approximately 45° relative to an axis of said pin." Johnson discloses a tapered pin having grooves and lands oriented at an angle of 30° relative to the axis of the pin. Johnson does not disclose, teach or suggest grooves and lands having an orientation of 45° relative to the axis of the pin. (See enclosed, enlarged, annotated Figure 8) Claim 13 is not anticipated or obvious in view of Johnson for at least this additional reason.

Claim 16 recites "wherein said second diameter is less than approximately 9% larger than said third diameter" the drawings of Johnson are not dimensional drawings and cannot be relied upon to anticipate or render obvious specific dimensional limitations of Applicant's claims. See MPEP § 2125. Johnson does not disclose, teach or suggest the limitations of claim 16. Claim 16 is patentable for at least this additional reason.

Claim 17 recites "wherein said retaining surface is carried on a formed portion of said pin and said lands have a surface area which is at least 40% of a surface area of said formed portion." The drawings of Johnson are not dimensional and cannot be relied upon to anticipate specific dimensional limitations recited in Applicant's claims.

See MPEP § 2125. Claim 17 is patentable over Johnson for at least this additional reason.

Claims 18 and 19 recite respectively "the width of said land is approximately five times said height" and "the width of said land is between five and fifteen times said height." The drawings of Johnson are not dimensional and cannot be relied upon to anticipate specific dimensional limitations of Applicant's claims. See MPEP § 2125. Further, the Examiner's proposed analysis from claims 7 and 8 on page 4 of the Office Action reveals a width to height ratio of approximately 3 to 1 which does not anticipate nor render obvious the Applicant's claimed ratios of "at least five" or "between five and fifteen times." Johnson does not disclose, teach or suggest the limitations of claims 18 and 19. Claims 18 and 19 are additionally patentable over Johnson for at least this additional reason.

Claim 21 recites as follows:

> A pin for insertion in a hole in a host material and frictional retention therein, comprising:
>
> an elongated cylindrical body having a longitudinal axis, a cylindrical pilot portion, and a retainer portion defined by a plurality of alternating helical lands and grooves, wherein said lands provide a retaining surface for engaging an inside surface of the hole;
>
> said retaining surface being a radial distance from the axis that is greater than a radius of the pilot portion and occupying at least approximately 40% of the circumference of the retainer portion when the retainer portion is viewed in cross section perpendicular to said axis.

Claim 21 requires "an elongated cylindrical body having a longitudinal axis, a cylindrical pilot portion, and a retainer portion defined by a plurality of alternating helical lands and grooves." Johnson teaches only taper pins and cannot anticipate or render obvious the quoted recitations of claim 21. Claim 21 further requires "said retaining surface being a radial distance from the axis that is greater than a radius of the pilot portion and occupying at least approximately 40% of the circumference of the retainer portion when the retainer portion is viewed in cross section perpendicular to

said axis." The drawings of Johnson are not dimensional and cannot be used to anticipate specific dimensional limitations in Applicant's claims. See MPEP § 2125. Johnson does not disclose, teach or suggest any particular ratio or relationship between the circumference of the disclosed tapered pin and the surface area of the tapered land surfaces shown in Figure 9. Johnson does not disclose, teach or suggest the recitations of claim 21. Claim 21 is patentable over Johnson for at least these reasons.

Claim Rejections 35 USC § 103

Claim 14 is rejected as being obvious over Johnson. Claim 14 recites in pertinent part "wherein said first and second hardnesses are measured on the Rockwell Rc scale and said first hardness is approximately 10 points higher on the Rockwell Rc scale than said second hardness." Johnson does not disclose, teach or suggest any particular differential between a host material hardness and pin hardness. Johnson cannot anticipate or render obvious the recitations of claim 14. Claim 14 is patentable over Johnson for at least this additional reason.

For all the foregoing reasons, Applicant respectfully requests allowance of claims 1 - 21.

Respectfully submitted,

RICHARD C. CAPONI

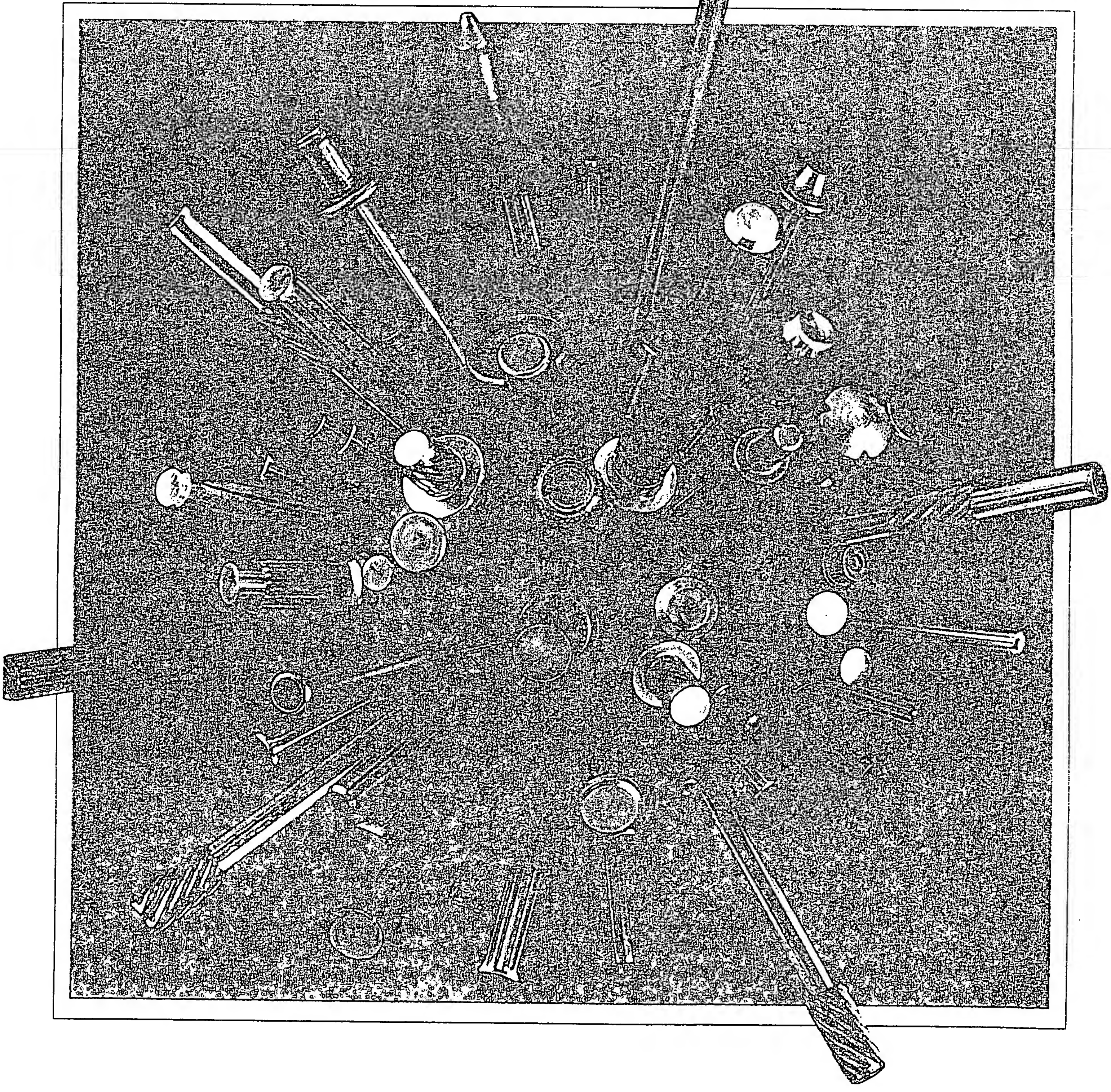
Thomas J. Menard
Registration No. 42,877
Alix, Yale & Ristas, LLP
Attorney for Applicant

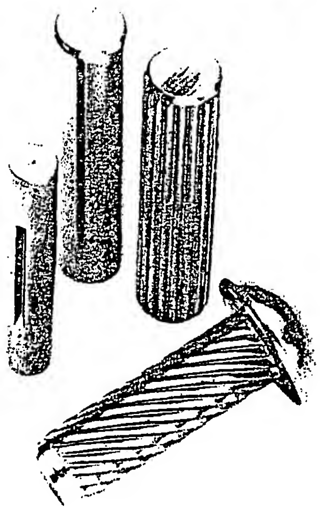
Date: April 27, 2005
750 Main Street
Hartford, CT 06103-2721
Our Ref: SPIROL/111/US
TJM:io

G:\AYR saved docs\Filing Docs\Spirol\spirol.111.us\spirol.111.us.response.04-26-05.doc

SPIROL®

SOLID PINS





THE SPIROL CONCEPT

Our objective is to reduce component and/or assembly cost. Based on fifty years of experience in solution selling and in-depth knowledge of installation and assembly processes, we are uniquely qualified to recommend the most cost-effective pinning solution.

We minimize cost through standardization of raw material, tooling concepts and production processes, and investment in state-of-the-art cold heading and secondary processing technology. Our products are designed to meet ASME and ISO standards and our internal production processes are controlled by continuous in-process monitors and procedures certified to QS-9000.

Starting with an analysis of your needs and objectives, Spirol Engineers determine the best standard or special pin for your application, giving consideration to performance requirements, ease of production, automatic feeding and orientation, and installation. The replacement of costly, machined components is one of our specialties.

Challenge us!

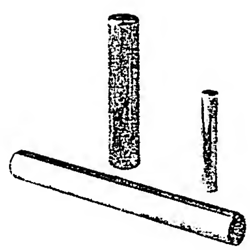
Standard Solid Pins and Drive Studs — Specifying standard solid pins and studs provides the lowest cost and quick availability. Our standard solid pins and drive studs, along with design considerations, are described on the following pages.

DESIGN CONSIDERATIONS – RETENTION MECHANICS

"Press fit fasteners" is a term used to describe fasteners that retain themselves in the assembly by the friction between the pin and host. The majority of our solid pin products fit this description.

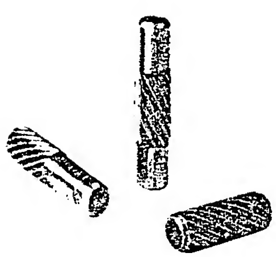
Retention mechanics is one of the most important parts of recommending the correct pin for an application.

Straight Pins



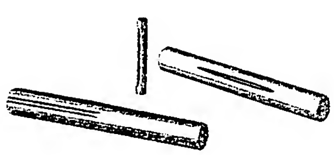
- Straight pins are retained by compressing the host, not the pin.
- Press fit applications for straight pins are limited to those cases where the host material can withstand compression in the order of .003"-.008"; plastics.
- Acceptable press fits in metal are typically between .002"-.005" and not suitable for Spirol straight pins due to diameter tolerancing.
- Spirol straight pins are best suited for applications that do not require the diameter tolerance of a ground dowel.

Knurled Pins



- Knurled pins are retained in the hole by cutting into the softer host material.
- The pin should always be harder than the host. If additional hardness is required to keep the knurls from shearing, the pins are case hardened.
- A knurled pin offers numerous points of contact in the host which distributes the radial stress in a uniform fashion.
- A 30° helical knurl causes the pin to rotate as it enters the hole and has more surface contact with the host. This results in higher friction forces, greater engagement and resistance to back out.
- A 30° helical knurl will also compensate for slight pin/hole misalignment as the rotating pin tends to align holes easier.

Grooved Pins



- Grooved pins are retained by a combination of compressing the host and compressing the pin.
- Grooved pins are good in hard materials or when the pin must be removed without hole damage.
- The purpose of the groove is to retain the pin in the host. As the pin is installed into the hole, the grooves yield and close back toward the original ungrooved state. In these applications the host material should have a higher tensile strength than the pin.

DESIGN CONSIDERATIONS – MATERIAL & FINISHES

Our standard raw material was selected to meet the requirements of ASME and ISO product standards and to cover a range of requirements as dictated by the market.

Standard Materials

AISI 1022 low carbon steel is work hardened to 70k psi tensile strength. **This is the preferred standard for all pins except grooved pins.** 1022 may be case hardened with a .005" - .010" effective case depth to produce a high wear surface on straight pins or high strength knurls on knurled pins.

AISI 12L14 low carbon steel is work hardened to 110k tensile strength. It is used for standard, non-heat treated and case hardened grooved pins. 12L14 was selected over 1022 for grooved pins because it reduces the swelling between grooves.

AISI 4037 alloy steel is work hardened to 100k psi tensile strength. It is used for pins requiring high strength without heat treatment. 4037 may be through hardened to achieve increased strength. The standard for through hardening is 36-42Rc. This material is more economical than 6150 and is used when the strength of 6150 is not required.

AISI 6150 high alloy steel is heat treated to 43-49Rc with a resulting tensile strength of 200k psi. It is the highest strength material available. 6150 is considered a "tough" material even at the higher hardness levels.

AISI 305 corrosion resistant stainless steel is work hardened to 120k tensile strength. **This is the preferred standard when stainless steel is required.** 305 has the best corrosion resistance of the stainless steels offered. It is a non-heat treatable grade.

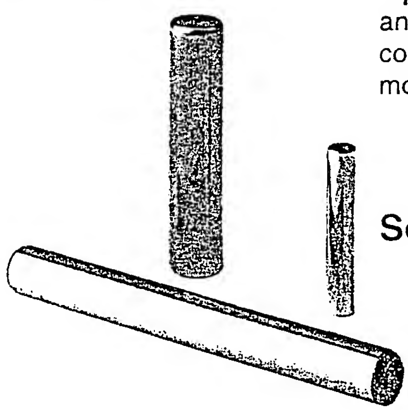
MATERIAL		TENSILE (min. psi)
F -	Low Carbon Steel	70,000
V -	Low Carbon Steel, Case Hardened	85,000
B -	AISI 4037 Alloy Steel	110,000
J -	AISI 4037 Alloy Steel, Hardened 36-42 Rc	150,000
W -	AISI 6150 High Strength Alloy Steel, Hardened 43-49 Rc	200,000
D -	300 Series Austenitic Stainless Steel	120,000

Other Materials on Request

FINISHES	
K -	Plain, Oiled
T -	Zinc Plated ASTM B633 SC1, Type 1
R -	Phosphate Coated DOD-P-16232 Type Z, Class 2
P -	Passivated ASTM A967

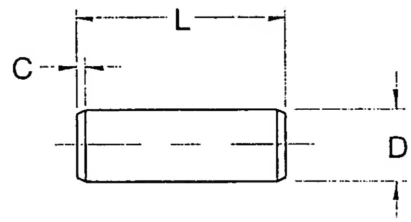
Other Finishes on Request

STRAIGHT PINS



Spirol® Straight Pins are differentiated by their uniformity, consistently high CPK's, and the absence of defects such as nibs and burrs. The chamfered ends are more consistent than tumbled edges—making installation with automatic assembly equipment more reliable. These pins are often used to replace ground dowels.

Series DP100



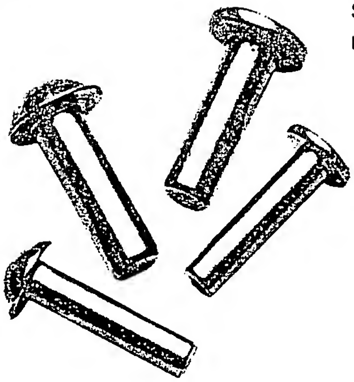
		INCH SPECIFICATIONS							METRIC SPECIFICATIONS						
Nominal Diameter		1/16 .0625	3/32 .0938	1/8 .125	5/32 .1563	3/16 .1875	1/4 .250		1.5	2	2.5	3	4	5	6
Diameter "D"	Min.	.0605	.0918	.123	.1543	.1855	.248	Min.	1.45	1.95	2.45	2.95	3.95	4.95	5.95
	Max.	.0625	.0938	.125	.1563	.1875	.250	Max.	1.5	2	2.5	3	4	5	6
Chamfer "C"	Min.	.005	.005	.005	.005	.016	.016	Min.	0.15	0.15	0.15	0.15	0.4	0.4	0.4
Length "L"	.250							6							
	.312							8							
	.375							10							
	.438							12							
	.500							14							
	.562							16							
	.625			Length Tolerance ± .010				20			Length Tolerance ± 0.25				
	.750							24							
	.875							26							
	1.000							30							
	1.250							35							
	1.500							40							
	1.750							45							
	2.000							50							
	2.250							55							
								60							

Notes:
- Standard material: Low Carbon Steel and 300 Series Austenitic Stainless Steel.
- Other diameters and lengths available on request.
- Spirol straight pins conform to ASME B18.8.2.6 and ISO 2338 Type C.
- Dimensions apply before plating.

Part Number Code

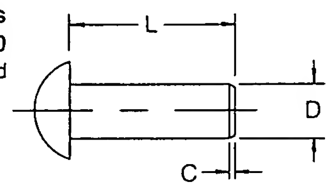
TO ORDER: (Nominal Diameter)x(Length)(Material)(Finish)(Pin Series Number)
EXAMPLE: .156 x 1.250 VT DP100

SPIROL® HEADED PINS

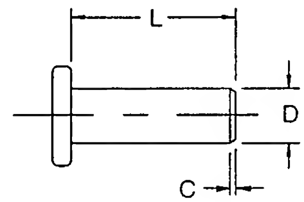


Spirol® Headed Pins are produced with the same uniformity and high CPK as the standard DP100 straight pins. Headed pins may be used as axles or hinge pins when movement in one direction must be limited.

Series
H100
Round Head



Series
H200
Flat Head



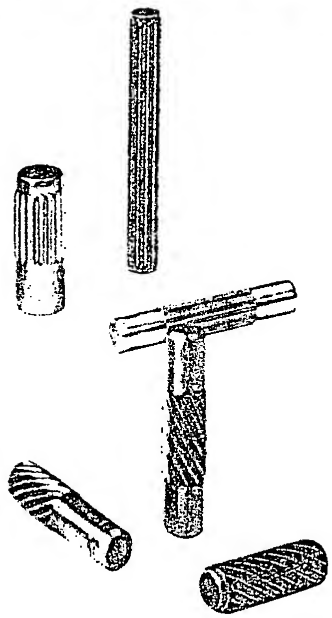
		INCH SPECIFICATIONS											METRIC SPECIFICATIONS							
Pin Size		0	2	4	6	7	8	10	12	14	16		1.4	1.6	2	2.5	3	4	5	6
Diameter "D"	Min.	.065	.084	.102	.118	.134	.142	.159	.194	.219	.248	Min.	1.35	1.55	1.95	2.45	2.95	3.95	4.95	5.95
	Max.	.067	.086	.104	.120	.136	.144	.161	.196	.221	.250	Max.	1.4	1.6	2	2.5	3	4	5	6
Head Diameter	Min.	.120	.146	.193	.240	.267	.287	.334	.382	.429	.443	Min.	2.20	2.60	3.30	4.20	4.95	6.75	8.50	10.2
	Max.	.130	.162	.211	.260	.285	.309	.359	.408	.457	.472	Max.	2.60	3.00	3.70	4.60	5.45	7.25	9.10	10.8
Round Head Thickness	Min.	.040	.059	.075	.091	.099	.107	.124	.140	.156	.161	Min.	0.70	0.90	1.10	1.40	1.65	2.25	2.85	3.45
	Max.	.050	.070	.086	.103	.111	.119	.136	.152	.169	.174	Max.	0.90	1.10	1.30	1.60	1.95	2.55	3.15	3.75
Flat Head Thickness	Min.	.017	.024	.030	.034	.039	.042	.048	.059	.068	.077	Min.	0.35	0.45	0.55	0.70	0.90	1.20	1.50	1.90
	Max.	.027	.035	.041	.046	.051	.054	.060	.071	.081	.090	Max.	0.55	0.65	0.75	0.90	1.20	1.50	1.80	2.20
Chamfer "C"	Min.	.005	.005	.005	.005	.005	.005	.016	.016	.016	.016	Min.	0.15	0.15	0.15	0.15	0.15	0.4	0.4	0.4
	.188											5								
Length	.250											6								
	.313											8								
	.375											10								
	.500					Length Tolerance ± .010						12					Length Tolerance ± 0.25			
	.562											16								
	.625											20								
	.750											24								
	.875											26								
	1.000											30								
	1.250											35								
	1.500											40								
	1.750											45								
	2.000											50								
	2.250											55								
	2.500											60								

Note:
- Standard material: Low Carbon Steel and 300 Series Austenitic Stainless Steel.
- Other lengths available on request.
- Dimensions apply before plating.

Part Number Code

TO ORDER: (Pin Size)x(Length)(Material)(Finish)(Pin Series Number)
EXAMPLE: #6 x .500 FK H200

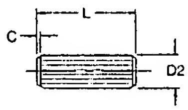
KNURLED PINS



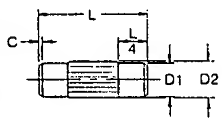
Spirol® Knurled Pins are available with straight or helical knurls. The multicrested design evenly distributes the retention force—making it the ideal pin for soft materials and thin cross-sections. Helical knurls have the additional benefit of turning the pin into the hole during installation. This assists material flow and hole alignment while eliminating knurl shearing and chips.

Straight Knurl

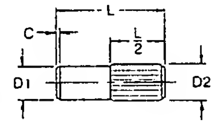
Series KP100
Full Length



Series KP110
Half Length
Centered

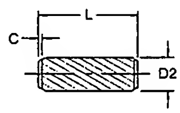


Series KP120
Half Length
Offset

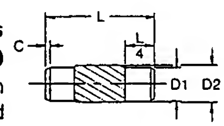


Helical Knurl

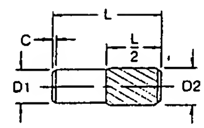
Series KP200
Full Length



Series KP210
Half Length
Centered



Series KP220
Half Length
Offset



	INCH SPECIFICATIONS							METRIC SPECIFICATIONS							
Nominal Diameter		1/16 .0625	3/32 .0938	1/8 .1250	5/32 .1563	3/16 .1875	1/4 .2500		1.5	2	2.5	3	4	5	6
Diameter "D1"	Min. Max.	.0605 .0625	.0918 .0938	.123 .125	.1543 .1563	.1855 .1875	.248 .250	Min. Max.	1.45 1.5	1.95 2	2.45 2.5	2.95 3	3.95 4	4.95 5	5.95 6
Diameter "D2"	Min. Max.	.068 .072	.099 .103	.131 .135	.163 .167	.195 .199	.256 .260	Min. Max.	1.63 1.73	2.2 2.3	2.7 2.8	3.25 3.35	4.25 4.35	5.25 5.35	6.25 6.35
Chamfer "C"	Min.	.005	.005	.005	.005	.016	.016	Min.	0.15	0.15	0.15	0.15	0.4	0.4	0.4
Recommended Hole	Min. Max.	.0625 .0640	.0938 .0956	.1250 .1271	.1563 .1587	.1875 .1903	.2500 .2534	Min. Max.	1.5 1.56	2 2.06	2.5 2.56	3 3.06	4 4.08	5 5.08	6 6.08
Length "L"	.250							6							
	.312							8							
	.375							10							
	.438							12							
	.500							14							
	.562			Length Tolerance				16				Length Tolerance			
	.625			± .010				20				± 0.25			
	.750							24							
	.875							26							
	1.000							30							
	1.250							35							
	1.500							40							
	1.750							45							
	2.000							50							
	2.250							55							

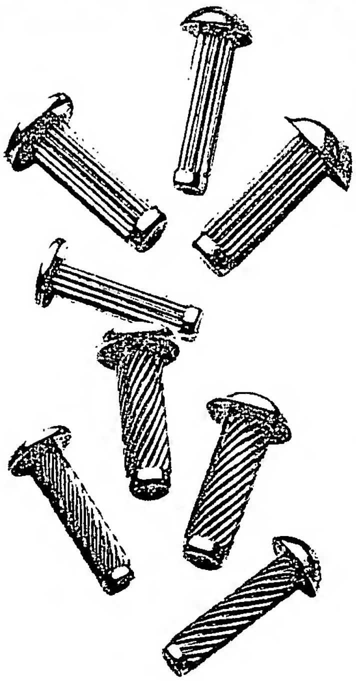
Notes:
- Standard material: Low Carbon Steel and 300 Series Austenitic Stainless Steel.
- Recommended hole sizes are given for average conditions.
  Required hole size is dependent on length of knurl engagement and hardness of host material.
- Other diameters and lengths available on request.
- Dimensions apply before plating.

Part Number Code

TO ORDER: (Nominal Diameter)x(Length)(Material)(Finish)(Pin Series Number)
EXAMPLE: 2 x 20 FK KP100

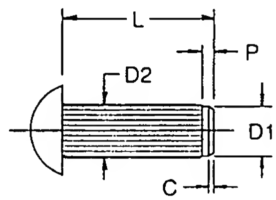
KNURLED DRIVE STUDS

Spirol® Knurled Drive Studs are headed and knurled fasteners used to replace screws. Typical applications include: fastening cover plates, name plates, knobs, clamps, brackets, and heat sinks. Since knurled drive studs can be installed faster than threaded fasteners, they present a significant labor reduction opportunity.

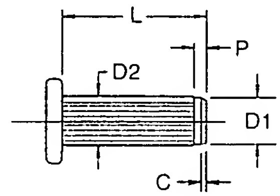


Straight Knurl

Series HP100
Round Head

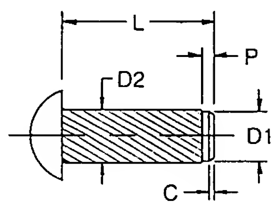


Series HP200
Flat Head

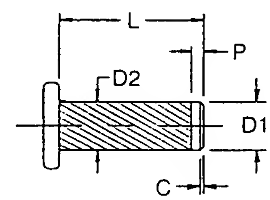


Helical Knurl

Series HP110
Round Head



Series HP210
Flat Head



INCH SPECIFICATIONS

Stud Size		0	2	4	6	7	8	10	12	14	16
Diameter "D1"	Min.	.065	.084	.102	.118	.134	.142	.159	.194	.219	.248
	Max.	.067	.086	.104	.120	.136	.144	.161	.196	.221	.250
Diameter "D2"	Min.	.072	.093	.112	.129	.145	.154	.171	.205	.230	.259
	Max.	.076	.097	.116	.133	.149	.158	.175	.209	.234	.263
Head Diameter	Min.	.120	.146	.193	.240	.267	.287	.334	.382	.429	.443
	Max.	.130	.162	.211	.260	.285	.309	.359	.408	.457	.472
Round Head Thickness	Min.	.040	.059	.075	.091	.099	.107	.124	.140	.156	.161
	Max.	.050	.070	.086	.103	.111	.119	.136	.152	.169	.174
Flat Head Thickness	Min.	.017	.024	.030	.034	.039	.042	.048	.059	.068	.077
	Max.	.027	.035	.041	.046	.051	.054	.060	.071	.081	.090
Chamfer "C"	Min.	.005	.005	.005	.005	.005	.005	.016	.016	.016	.016
Pilot Length "P"	Ref.	.031	.031	.031	.031	.062	.062	.062	.062	.062	.062
Length	.188										
	.250										
	.313										
	.375					Length Tolerance ± .010					
	.500										
	.625										
	.750										
Rec. Drill Size		51	44	37	31	29	27	20	9	2	1/4
Hole Diameter	Min.	.0670	.0860	.1040	.1200	.1360	.1440	.1610	.1960	.2210	.2500
	Max.	.0686	.0877	.1059	.1220	.1382	.1463	.1636	.1990	.2240	.2534

METRIC SPECIFICATIONS

Stud Size		1.4	1.6	2	2.5	3	4	5	6
Diameter "D1"	Min.	1.35	1.55	1.95	2.45	2.95	3.95	4.95	5.95
	Max.	1.4	1.6	2	2.5	3	4	5	6
Diameter "D2"	Min.	1.53	1.73	2.20	2.70	3.25	4.25	5.25	6.25
	Max.	1.63	1.83	2.30	2.80	3.35	4.35	5.35	6.35
Head Diameter	Min.	2.20	2.60	3.30	4.20	4.95	6.75	8.50	10.2
	Max.	2.60	3.00	3.70	4.60	5.45	7.25	9.10	10.8
Round Head Thickness	Min.	0.70	0.90	1.10	1.40	1.65	2.25	2.85	3.45
	Max.	0.90	1.10	1.30	1.60	1.95	2.55	3.15	3.75
Flat Head Thickness	Min.	0.35	0.45	0.55	0.70	0.90	1.20	1.50	1.90
	Max.	0.55	0.65	0.75	0.90	1.20	1.50	1.80	2.20
Chamfer "C"	Min.	0.15	0.15	0.15	0.15	0.15	0.4	0.4	0.4
Pilot Length "P"	Ref.	1	1	1	1	1	2	2	2
Length	5								
	6								
	8					Length Tolerance ± 0.25			
	10								
	12								
	16								
	20								
Rec. Drill Size		1.4	1.6	2.0	2.5	3.0	4.0	5.0	6.0
Hole Diameter	Min.	1.4	1.6	2.0	2.5	3.0	4.0	5.0	6.0
	Max.	1.46	1.66	2.06	2.56	3.06	4.08	5.08	6.08

Notes:
- Standard material: Low Carbon Steel and 300 Series Austenitic Stainless Steel.
- Spirol® drive studs comply with ASME B18.8.2, except knurls replace grooves.
- Other lengths available on request.
- Dimensions apply before plating.

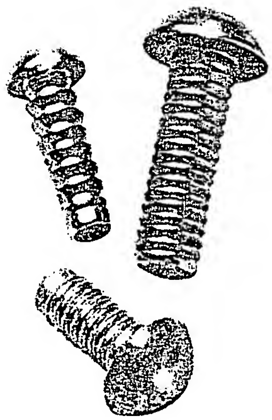
Part Number Code

TO ORDER: (Stud Size)x(Length)(Material)(Finish)(Pin Series Number)

EXAMPLE: #12 x .625 WK HP110

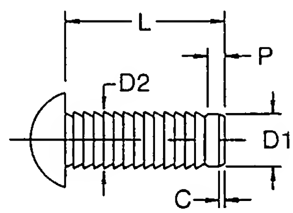
BARBED DRIVE STUDS

Spirol® Barbed Drive Studs are headed pins for applications that require high pull out values or where the intent is to prevent disassembly and tampering. Easy to install, typical applications for barbed drive studs are similar to those for drive studs.

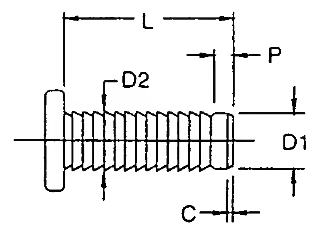


Barbed

Series HP120
Round Head



Series HP220
Flat Head



		INCH SPECIFICATIONS									
Stud Size		0	2	4	6	7	8	10	12	14	16
Diameter "D1"	Min.	.065	.084	.102	.118	.134	.142	.159	.194	.219	.248
	Max.	.067	.086	.104	.120	.136	.144	.161	.196	.221	.250
Diameter "D2"	Min.	.077	.096	.118	.134	.150	.158	.175	.210	.235	.264
	Max.	.081	.100	.123	.139	.155	.163	.180	.215	.240	.270
Head Diameter	Min.	.120	.146	.193	.240	.267	.287	.334	.382	.429	.443
	Max.	.130	.162	.211	.260	.285	.309	.359	.408	.457	.472
Round Head Thickness	Min.	.040	.059	.075	.091	.099	.107	.124	.140	.156	.161
	Max.	.050	.070	.086	.103	.111	.119	.136	.152	.169	.174
Flat Head Thickness	Min.	.017	.024	.030	.034	.039	.042	.048	.059	.068	.077
	Max.	.027	.035	.041	.046	.051	.054	.060	.071	.081	.090
Chamfer "C"	Min.	.005	.005	.005	.005	.005	.005	.016	.016	.016	.016
Pilot Length "P"	Ref.	.031	.031	.031	.031	.062	.062	.062	.062	.062	.062
Length	.188										
	.250										
	.313										
	.375										
	.500					Length Tolerance ± .010					
	.625										
	.750										
Rec. Drill Size		51	44	37	31	29	27	20	9	2	1/4
Hole Diameter	Min.	.0670	.0860	.1040	.1200	.1360	.1440	.1610	.1960	2210	2500
	Max.	.0686	.0877	.1059	.1220	.1382	.1463	.1636	.1990	2240	2534

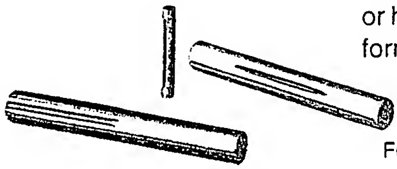
		METRIC SPECIFICATIONS							
Stud Size		1.4	1.6	2	2.5	3	4	5	6
Diameter "D1"	Min.	1.35	1.55	1.95	2.45	2.95	3.95	4.95	5.95
	Max.	1.4	1.6	2	2.5	3	4	5	6
Diameter "D2"	Min.	1.60	1.80	2.36	2.86	3.36	4.36	5.36	6.36
	Max.	1.70	1.90	2.46	2.96	3.46	4.46	5.46	6.46
Head Diameter	Min.	2.20	2.60	3.30	4.20	4.95	6.75	8.50	10.2
	Max.	2.60	3.00	3.70	4.60	5.45	7.25	9.10	10.8
Round Head Thickness	Min.	0.70	0.90	1.10	1.40	1.65	2.25	2.85	3.45
	Max.	0.90	1.10	1.30	1.60	1.95	2.55	3.15	3.75
Flat Head Thickness	Min.	0.35	0.45	0.55	0.70	0.90	1.20	1.50	1.90
	Max.	0.55	0.65	0.75	0.90	1.20	1.50	1.80	2.20
Chamfer "C"	Min.	0.15	0.15	0.15	0.15	0.15	0.40	0.40	0.40
Pilot Length "P"	Ref.	1	1	1	1	1	2	2	2
Length	5								
	6								
	8					Length Tolerance ± 0.25			
	10								
	12								
	16								
	20								
Rec. Drill Size		1.4	1.6	2.0	2.5	3.0	4.0	5.0	6.0
Hole Diameter	Min.	1.4	1.6	2.0	2.5	3.0	4.0	5.0	6.0
	Max.	1.46	1.66	2.06	2.56	3.06	4.08	5.08	6.08

Notes:
- Standard material: Low Carbon Steel and 300 Series Austenitic Stainless Steel.
- Other lengths available on request.
- Dimensions apply before plating.

Part Number Code

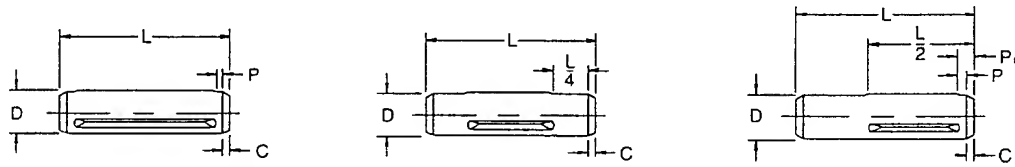
TO ORDER: (Stud Size)x(Length)(Material)(Finish)(Pin Series Number)
EXAMPLE: 3 x 10 WK HP220

GROOVED PINS



Spirol® Grooved Pins are produced with parallel grooves for maximum holding power along the entire groove length. The three swaged grooves make them ideal pins for harder or higher tensile materials. When installed into a hole, the expanded grooves compress to form a locking fit.

Series GP100	Series GP110	Series GP120
Full Length	Half Length Centered	Half Length Offset



		INCH SPECIFICATIONS						METRIC SPECIFICATIONS					
Nominal Diameter		3/32 .0938	1/8 .1250	5/32 .1563	3/16 .1875	1/4 .2500		2	2.5	3	4	5	6
Diameter "D"	Min.	.0923	.123	.1543	.1855	.248	Min.	1.96	2.46	2.96	3.95	4.95	5.95
	Max.	.0938	.125	.1563	.1875	.250	Max.	2	2.5	3	4	5	6
Chamfer "C"	Min.	.005	.005	.005	.016	.016	Min.	0.15	0.15	0.15	0.4	0.4	0.4
Length "L" ± .010 inches ± .25 mm	Min.	.250	.250	.313	.313	.438	Min.	6	6	6	8	10	10
	Max.	1.000	1.250	1.500	1.750	2.000	Max.	20	20	30	40	50	50
Pilot Length "P"	Ref.	.031	.031	.062	.062	.062	Ref.	Not Applicable					
Pilot Length "P_1"	Min.	Not Applicable					Min.	1	1.5	1.5	2	2	3
	Max.						Max.	2	2.5	2.5	3	3	4
Recommended Hole	Min.	.0938	.1250	.1563	.1875	.2500	Min.	2	2.5	3	4	5	6
	Max.	.0956	.1271	.1587	.1903	.2534	Max.	2.06	2.56	3.06	4.075	5.075	6.075
Material		Minimum Double Shear Lbs.						Minimum Double Shear kN					
Low Carbon Steel		890	1600	2300	3310	5880		2.2	3.5	5	8.8	13.8	19.9
High Strength Alloy Steel		1600	2820	4520	6440	11500		5.3	7.9	11.9	20.2	31.7	45.8
Austenitic SS		1240	2200	3310	4760	8460		3.9	6.0	8.7	14.9	23.4	33.8

Groove Length — Expanded Diameter (Inch)

Groove Length	±.0015 (3/32)	±.002 (1/8)	±.002 (5/32)	±.002 (3/16)	±.002 (1/4)
.250					
.313					
.375	.101*				
.438	.099**	.134*			
.500		.132**	.166*		
.562			.164**	.198*	
.625				.195**	
.750					.263*
.875	.100*	.133*	.165*		.260**
1.000	.098**	.131**	.163**		
1.250		.132*	.164*	.197*	
1.500		.130**	.162**	.194**	
1.750			.163*		.262*
2.000			.161**	.196*	.259**
				.193**	

Groove Length — Expanded Diameter (Metric)

Groove Length	±0.05 (2)	±0.05 (2.5)	±0.06 (3)	±0.06 (4)	±0.06 (5)	±0.06 (6)
6						
8	2.17*	2.70*				
10	2.15**	2.66**	3.24*			
12			3.19**	4.26*		
14				4.21**	5.31*	
16					5.24**	6.35*
20	2.14*					6.27**
24	2.12**	2.67*		4.23*		
26		2.63**	3.21*	4.18**	5.28*	
30			3.16**		5.21**	
35						6.32*
40				4.21*		6.27**
45				4.16**	5.26*	
50					5.19**	6.29*
						6.21**

Groove length shall be considered as being substantially equal to the pin length for Series GP100, and equal to one-half of the pin length for Series GP110 and GP120.

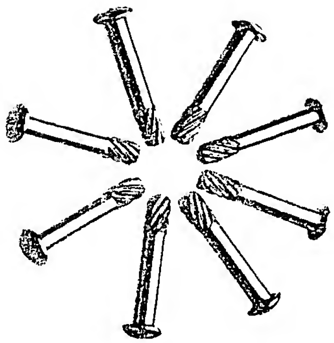
* Carbon and High Strength Alloy Steel
** Austenitic Stainless Steel

Notes:
- Standard material: Low Carbon Steel.
- Spirol® inch grooved pins comply with ASME B18.8.2.7. Metric lengths and diameters comply with ASME B18.8.9M.
- Conformance of expanded diameters to dimensional specifications are determined with ring gages.
- The maximum hole limits are suitable for length-diameter ratios not less than 4 to 1 and not greater than 10 to 1. Smaller ratios may require closer tolerances and conversely larger ratios may require larger holes.
- Other lengths available on request.
- Dimensions apply before plating.

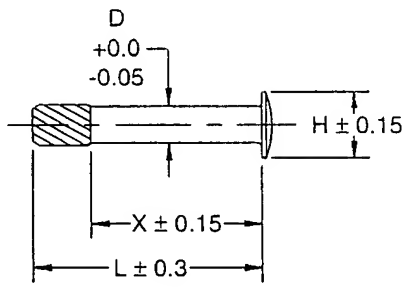
Part Number Code

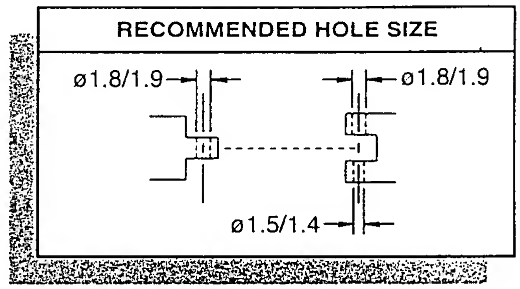
TO ORDER: (Nominal Diameter)x(Length)(Material)(Finish)(Pin Series Number)
EXAMPLE: .093 x 1.000 WK GP100

TWIST-LOK™ PINS



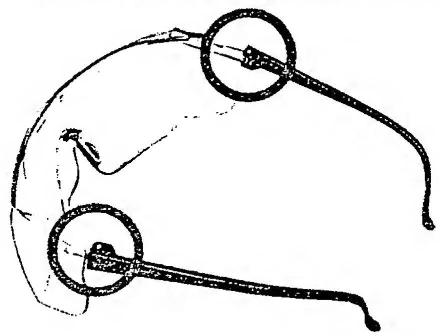
Spirol® Twist-Lok™ Pins replace screws and rivets as a superior hinge pin in plastic eyeglass frame applications. The helical knurl minimizes stress during installation by rotating as it engages the hinge. The pins replace costly screw machined pins and eliminate problematic installation of screws and rivets. Corrosion-resistant material and a rounded burr-free head improve eyeglass frame appearance. Axial and radial forces induced in the hinge eliminate the tendency for the pin to creep and maintain hinge tension.





METRIC SPECIFICATIONS			
Diameter "D"	Head Diameter "H"	Length "L"	Length "X"
1.60	2.85	6	4.5
		8	6
		10	7.5

Lengths available: 6-16mm

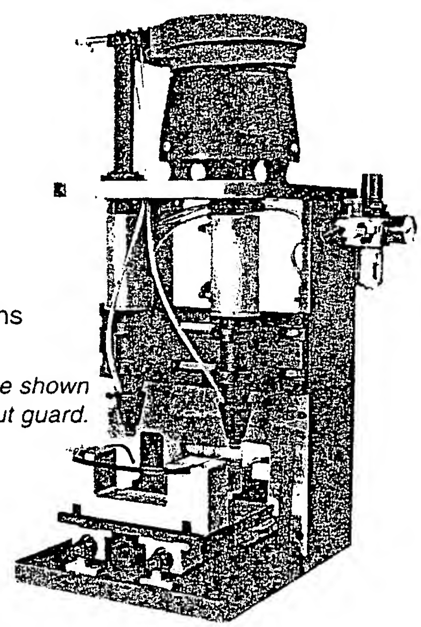


Spirol Model SG Automatic Pin Inserter

OPERATION:
Simultaneous installation of headed pins into Safety Glass assembly.

MACHINE CYCLE TIME:
3 seconds.

SEQUENCE:
1. Operator places Safety Glass lens and temples into fixture.
2. Operator activates dual push buttons.
3. Pin inserter advances, inserts two Twist-Lok™pins simultaneously, and retracts.
4. Operator unloads pinned assembly.



Machine shown without guard.

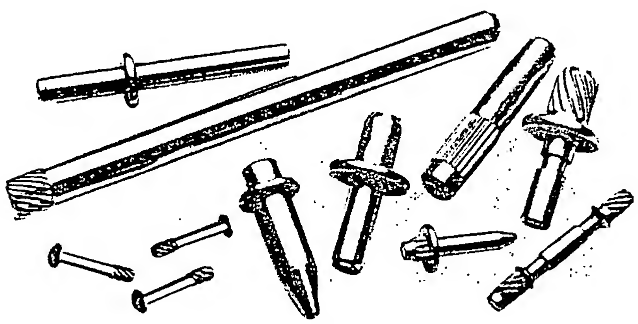
MACHINE FEATURES
- Adjustable centerlines
- Installs multiple pin sizes without adjustment
- Compact design
- Simple, maintenance-free controls

SPIROL INTERNATIONAL CORPORATION

Spirol is a registered trademark.

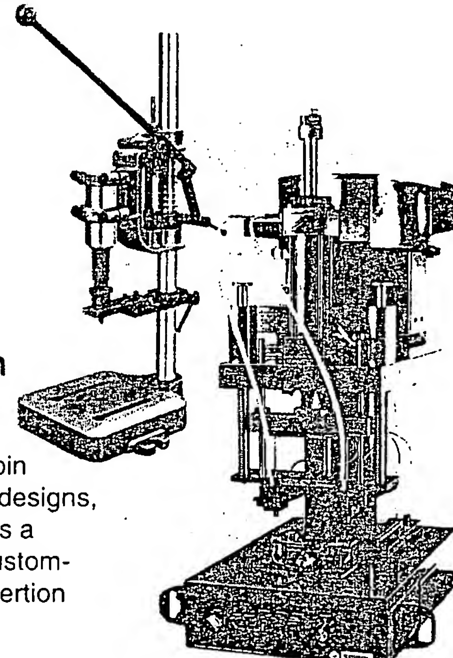
Special Formed Pins

Spirol's special forming capabilities were developed to meet the technical needs of high volume parts traditionally produced on screw machines. Our sales and application engineers use these capabilities to design products that solve difficult assembly problems at the lowest possible cost.



Spirol has developed processes for the following special features that may be formed on any of our standard pins listed in the catalog:

- straight, helical and diamond knurls
- annular grooves
- barbs
- collars, shoulders, and standoffs
- long chamfers
- spherical ends



Pin Insertion Equipment

Spirol is the only pin manufacturer that designs, builds and supports a complete line of custom-engineered pin insertion equipment.

Pin Selection and Sourcing Made Easy

In addition to solid pins and insertion equipment, Spirol manufactures coiled and slotted spring pins, tubular products, spacers, dowels bushings, spring dowels, tension sleeves, connectors, rivets, shims, inserts, compression limiters and parts feeding equipment.

Corporate Headquarters:
SPIROL INTERNATIONAL CORPORATION
30 Rock Avenue
Danielson, CT 06239-1434
(860) 774-8571
FAX: (860) 774-2048
E-mail: information@spirol.com
www.spirol.com

SPIROL WEST, INC.
645 E. Harrison Street, Suite 100
Corona, CA 92879-1347
(909) 273-5900
FAX: (909) 273-5907
E-mail: info@spirolwest.com
www.spirolwest.com

SPIROL INDUSTRIES, LTD.
3103 St. Etienne Blvd.
Windsor, Ontario N8W 5B1
CANADA
(519) 974-3334
FAX: (519) 974-6550
E-mail: infor@spirolcanada.com
www.spirolcanada.com

QS-9000 REGISTERED COMPANY

QS-9000 Certificate No 5981

In 1995, the Danielson, Connecticut facility of Spirol International achieved certification by National Quality Assurance (NQA) under ISO 9002, and in 1998, under QS-9000 with a scope of manufacturer of pins, bushing, and inserts.

CHALLENGE US!

ISO 9002 QS-9000 REGISTERED KPMG

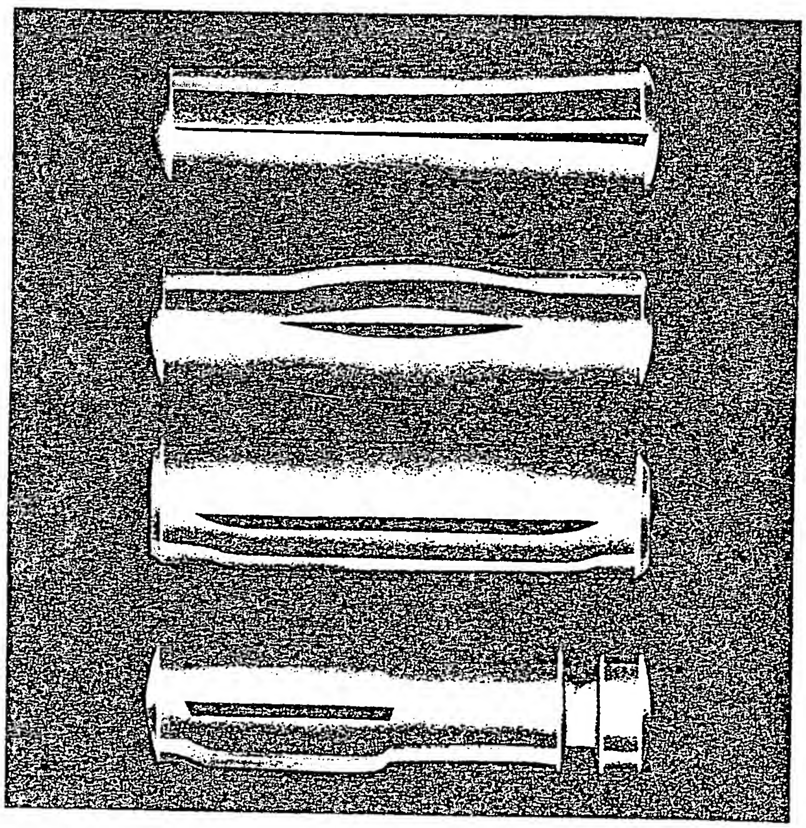
Certificate No 582

In 1998, the Windsor, Ontario facility achieved certification by KPMG against the ISO 9002 and QS-9000 Quality Assurance Management System Standards applicable to the manufacture and distribution of roll formed tubular products and associated pins, inserts and shims.

All solid pins are produced at the Connecticut facility.

 2.5M 9/01 Printed in U.S.A.

GROOVED PINS and DRIVE STUDS

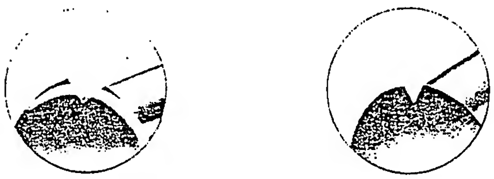


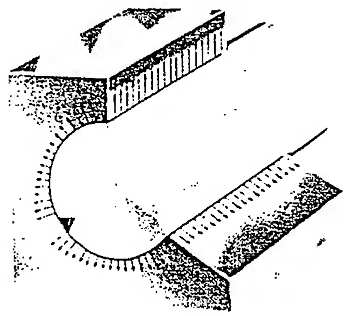
GROOV-PIN CORP.

1125 Hendricks Causeway
Ridgefield, NJ 07657
201-945-6780
Telex 710-922-8963

THE GROOVING PRINCIPLE

Before Inserting | After Inserting





Magnitude of Constraining Forces

A Groov-Pin* is a cylindrical pin with three longitudinal grooves, manufactured from bar or coil stock. The three grooves are swaged into the cylindrical body to expand the pin stock within controlled standard limits. These limits have been determined for best results under average conditions. No material is removed during the grooving process.

When this pin is forced into a drilled hole of the same diameter, the constraining action of the hole wall will cause the expanded material to be compressed and produce a locking fit.

The diagram of a Groov-Pin and work-piece cross-section shows the locking force between the work-piece and the expanded pin. This force fit resists severest shock and vibration—an important safety factor not found in other press fit fasteners. The inherent resilience of the grooved stock portion permits repeated use of Groov-Pins. This characteristic is especially advantageous in shop assembly involving demounting and re-assembly of parts. The same Groov-Pin may be re-used many times at barely reduced holding efficiency.

GROOV-PINS LOCK EFFECTIVELY

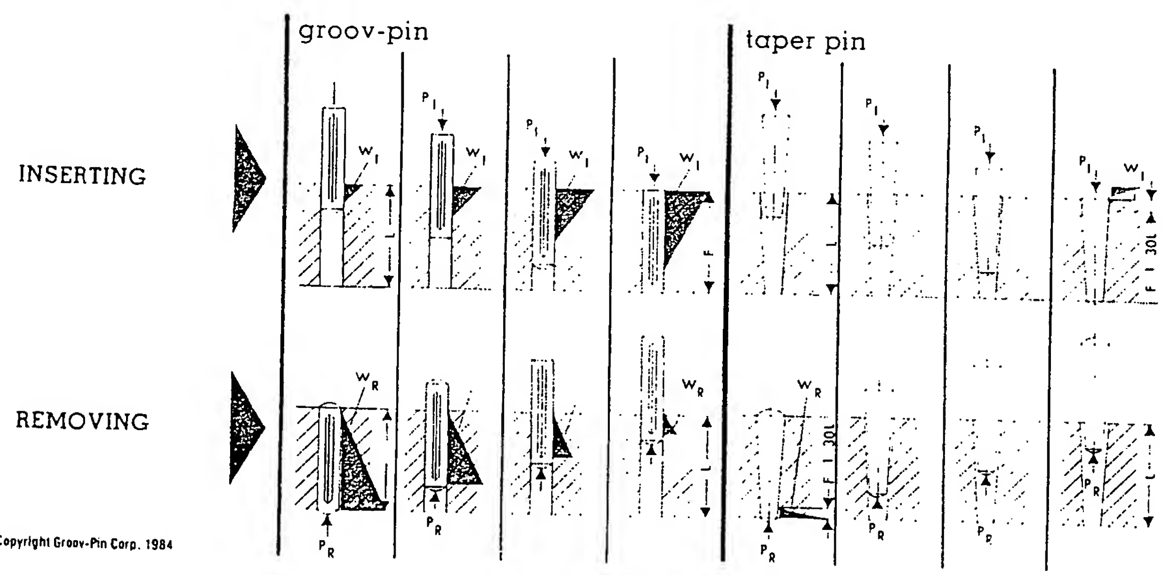
The diagrams below show how the locking forces obtained with Groov-Pins assure high resistance to severe shock and vibration as compared to taper pins.

A Groov-Pin requires considerable force from the moment it is started in the hole. This force increases in direct ratio to the depth of insertion, with corresponding increase in holding efficiency to a maximum at the point when full grooved pin length engagement takes place.

The taper pin, however, slides into position and is then pressed into its taper lock.

Conversely, the force necessary to drive a Groov-Pin from its companion piece gradually diminishes with parallel declining constraining action until the pin is completely removed. It would continue to function in cases involving involuntary axial pin displacement, with holding forces in direct ratio to the groove length engaged.

The taper pin, taper-locked within a very short movement along its axis, will drop out when a minor displacement occurs.



DRIV-LOK

FOR FASTENING

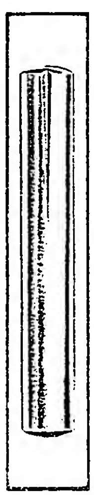
Wherever you pin metal to metal, DRIV-LOK Fasteners will give you positive holding power. Since entering the highly engineered self-locking pin industry in 1937, DRIV-LOK has specialized in the manufacture of quality Grooved Fasteners. In 1963 DRIV-LOK applied this more than a quarter century of engineering and manufacturing experience to a new line of high quality rolled Spring Pins. Now OEM industries call on DRIV-LOK to help solve all metal-to-metal pinning needs. We at DRIV-LOK provide a complete package of customer services including engineering assistance, quality manufacturing, fast delivery and competitive prices which make our Fasteners a more reliable and valuable component in your product.

INDEX

*ASA B.5.20 has been adopted by many industrial firms as their basic standard. Companies such as General Motors, Ford, Chrysler, International Harvester, General Electric and many more use these dimensions.

How DRIV-LOK grooved fasteners give positive holding action every time

DRIV-LOK Grooved Fasteners have three parallel, equally spaced grooves impressed longitudinally on their exterior surface. In impressing these grooves, the tool cuts below the surface, displacing a carefully determined amount of the metal stock. No chip is removed. The metal is displaced to each side of the cut, forming a raised portion or flute extending along each side of the groove. The crests of the flutes constitute expanded diameter "Dx" (Figure 1). Diameter "Dx" is a few thousandths larger than the nominal diameter "D" of the stock. The difference varies with the size of the pin and material used.



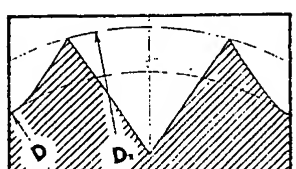


Figure 1—Enlarged sectional view of one of the grooves before inserting fastener.

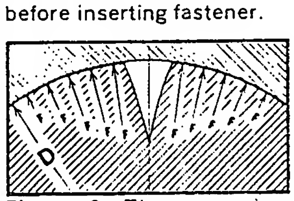


Figure 2—The same view after insertion. Powerful radial thrust is obtained.

Installation When the DRIV-LOK Grooved Fastener is forced into a drilled hole slightly larger than the nominal or specified diameter of the pin, the flutes are substantially forced back into the grooves (Figure 2). The resiliency of the metal forced back into the grooves creates powerful radial forces (F) which are exerted against the hole wall. These forces provide the positive self-locking feature of DRIV-LOK Grooved Fasteners.

Re-use DRIV-LOK Grooved Fasteners may be re-used a number of times. The number of re-uses depends upon the material, hardness, type of groove, etc.

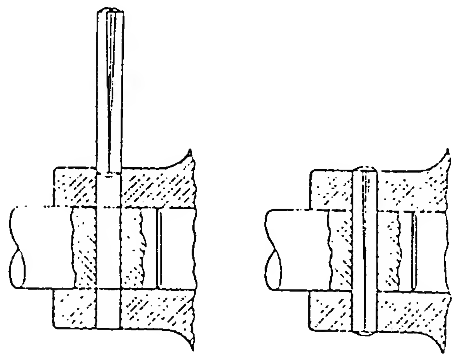
GROOV-PINS ARE EFFICIENT

They withstand severest shock and vibration.

They eliminate failures due to loose or disengaged pins.

They are solid.

They are made in different groove types to suit any particular application.



They require only a straight drilled hole, without the need for close tolerances, or reaming, peening, milling or tapping, necessary for other fasteners.

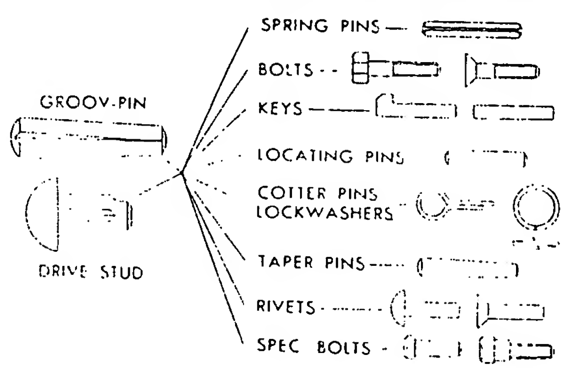
They reduce the number of operations.

They may be driven with a hammer, an air cylinder, hydraulic press, or be hopper-fed in automatic installation.

They permit a simple installation method and speed assembly, at corresponding savings in tool and labor costs.

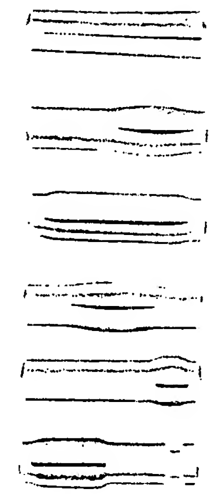
They can be re-used.

GROOV-PINS REPLACE THESE MACHINE ELEMENTS



GROOV-PINS

TYPES	
1	Full Length Taper
2A	Half Length
3H	Full Length Parallel, Symmetrical for Hopper Feeding
5	Half Length Center
24	Quarter Length Parallel
67	Half Length Parallel with Annular Groove



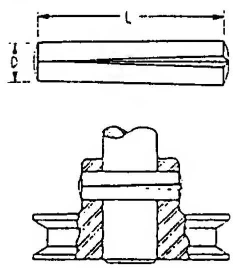
DRIVE STUDS

Standard Grooved and Offset Ribbed

INDEX

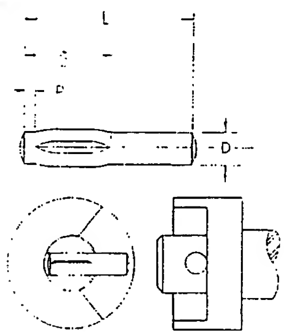
GROOV-PIN TYPES

1



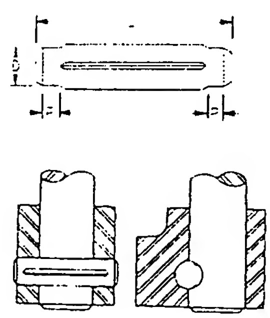
With three full length tapering grooves. It serves as connecting and fastening element and as such replaces the conventional taper pin, eliminating reaming of drilled holes, saving time and tool costs.

2A



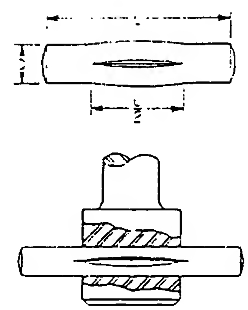
With three half-length grooves and short pilot, for both blind and thru holes.

3H



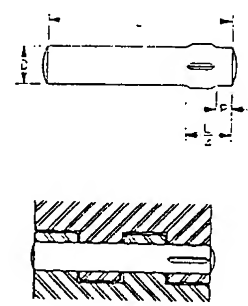
With three full length parallel grooves. Short pilots and chamfers permit insertion from either end, for hopper feeding.

5



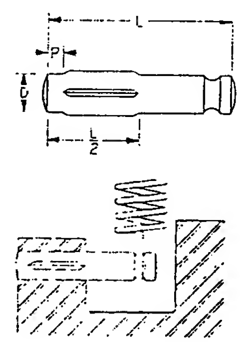
With three grooves, centrally located, extended over one-half pin length. Suitable as cross handle, hinge pin or fulcrum bolt, etc. and ideal for rod assemblies requiring neither head nor additional cotter pins.

24



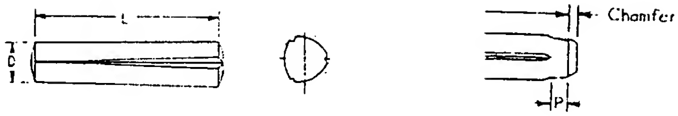
With three parallel grooves and pilot extending over one-quarter pin length. Designed for linkage, pivot and hinge applications. Parallel grooves give high holding power where shorter grooves and longer bearing area are required. The short pilot on grooved end allows entry of pin from either end and permits its use in either blind or through holes. Minimum groove length is 1/16''.

67



With three half-length parallel grooves and neck for tension springs. Type 67 is for both blind and thru holes and is used in automatic machinery and on tools requiring reciprocating spring action. Annular grooves may be machined to customer's specification as when pins are used with retainer rings. See page 6 for head and neck dimensions.

NOTE: Shorter or longer grooves than standard can be supplied to order, quantities permitting.



DIMENSIONS

Metric Equivalents Available.

Std. Stock Diam., D	1/32	3/64	1/16	5/64	3/32	7/64	1/8	5/32	3/16	7/32	1/4	5/16	3/8	7/16	1/2
Decimal Equivalent	.0312	.0469	.0625	.0781	.0938	.1094	.1250	.1563	.1875	.2188	.2500	.3125	.3750	.4375	.5000
Recom. Drill Size	1/32	3/64	1/16	5/64	3/32	7/64	1/8	5/32	3/16	7/32	1/4	5/16	3/8	7/16	1/2
Pilot Length, P	1/64	1/32	1/32	1/32	1/32	1/32	1/32	1/16	1/16	1/16	1/16	3/32	3/32	3/32	3/32
▲Chamfer Type 3H	none	none	1/64 x 30°					1/32 x 30°				3/64 x 30°			
EXPANDED DIAMETER as measured with ring gauge for all materials except stainless and monel ▪															
Groove Length															
1/8	.035	.051	.068	.084	.101	.117	.134	.166	.198	.230	.263	.329			
3/16	.035	.051	.068	.084	.101	.117	.134	.166	.198	.230	.263	.329	.394	.459	
1/4	.035	.051	.068	.084	.101	.117	.134	.166	.198	.230	.263	.329	.394	.459	.525
5/16	.035	.051	.068	.084	.101	.117	.134	.166	.198	.230	.263	.329	.394	.459	.525
3/8	.035	.051	.068	.084	.101	.117	.134	.166	.198	.230	.263	.329	.394	.459	.525
7/16	.035	.051	.068	.084	.101	.117	.134	.166	.198	.230	.263	.329	.394	.459	.525
1/2	.035	.051	.068	.084	.101	.117	.134	.166	.198	.230	.263	.329	.394	.459	.525
9/16		.051	.068	.084	.101	.117	.134	.166	.198	.230	.263	.329	.394	.459	.525
5/8		.051	.068	.084	.101	.117	.134	.166	.198	.230	.263	.329	.394	.459	.525
3/4			.067	.083	.100	.116	.134	.166	.198	.230	.263	.329	.394	.459	.525
7/8			.067	.083	.100	.116	.133	.165	.198	.230	.263	.329	.394	.459	.525
1			.067	.083	.100	.115	.133	.165	.198	.230	.263	.329	.394	.459	.525
1 1/4					.100	.115	.132	.164	.197	.230	.263	.329	.394	.459	.525
1 1/2								.164	.197	.229	.262	.329	.394	.459	.525
1 3/4								.163	.197	.229	.262	.328	.393	.459	.525
2								.163	.196	.229	.262	.328	.393	.458	.525
2 1/4									.196	.229	.262	.328	.393	.458	.524
2 1/2										.228	.261	.327	.393	.458	.524
2 3/4										.228	.261	.327	.393	.458	.524
3	Note: Expanded diameter is dependent on groove length, not pin length.									.227	.260	.327	.392	.457	.523
3 1/4											.260	.326	.392	.457	.523
3 1/2												.326	.391	.456	.522
3 3/4													.391	.456	.522
4													.390	.455	.521
4 1/4													.390	.455	.521
4 1/2														.454	.520

For stock pin lengths (L) see page 9

NOTE: Grooves 1/4" and shorter are normally supplied parallel. Type 2A and Type 5 grooves 7/32" and shorter are supplied parallel.

To find expanded diam. of groove lengths not shown use the next longer length

☐ Gray areas indicate non stocked sizes

Tolerances: Nominal Diam: 1/32 through 7/64 +.000, −.001
1/8 through 1/2 +.000, −.002

Expanded Diam: 1/32 through 7/64 ±.001
1/8 through 1/2 ±.002

Length: ±.010

▲chrome vanadium and other alloy pins not free machining are chamfered, not crowned and the chamfers are included in overall length. Chamfered dimensions are the same as shown for Type 3H. All pin lengths 1/4" and shorter are neither crowned nor chamfered.

▪Expanded diam. for SS and Monel

For stainless steel and monel the expanded diameters shown in above table are reduced by the amounts shown below:

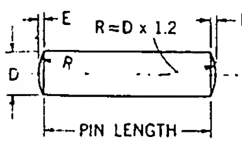
Pin Diam.	Expansion Reduced By	Pin Diam.	Expansion Reduced By
1/32	.001	5/32	.002
3/64	.001	3/16	.003
1/16	.002	7/32	.003
5/64	.002	1/4	.003
3/32	.002	5/16	.004
7/64	.002	3/8	.005
1/8	.002	7/16	.006
		1/2	.006

Specials: Intermediate pin and groove lengths, different groove shapes or expanded diameters can be furnished. Intermediate diameters can also be supplied, quantities permitting.

ENGINEERING INFORMATION

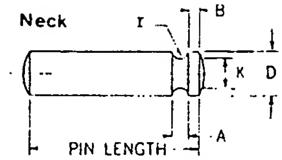
CROWN AND NECK DIMENSIONS

Crown



Tolerence on crown height is .... ±.005
Overall length of pin ... L+2E
Alloy pins are chamfered, not crowned and chamfers are included in length.

Neck



Tolerances for K .... ±.005
Tolerances for A .... +.007 .003
Tolerances for B .... +.010 000
Tolerances for r .... Reference

Chrome vanadium and other alloys not free machining have the corners of the neck broken to prevent burrs.

PIN DIAMETER, IN.

	1/32	3/64	1/16	5/64	3/32	7/64	1/8	5/32	3/16	7/32	1/4	5/16	3/8	7/16	1/2
Crown Radius, R	none	none	5/64	3/32	1/8	9/64	5/32	3/16	1/4	9/32	5/16	3/8	15/32	17/32	5/8
Crown Height, E	none	none	.0065	.0087	.0091	.011	.013	.017	.018	.022	.026	.034	.039	.047	.052
2E	none	none	.0130	.0174	.0182	.022	.026	.034	.036	.044	.052	.068	.078	.094	.104
Neck Radius, r	—	—	—	—	1/64	1/64	1/32	1/32	1/32	3/64	3/64	1/16	1/16	3/32	3/32
Neck Width, A	—	—	—	—	1/32	1/32	1/16	1/16	1/16	3/32	3/32	1/8	1/8	3/16	3/16
Shoulder Width, B	—	—	—	—	1/32	1/32	1/32	3/64	3/64	1/16	1/16	3/32	1/8	1/8	1/8
Neck Diameter, K	—	—	—	—	.062	.078	.083	.104	.125	.146	.167	.209	.250	.293	.312

☐ Gray areas indicate non stocked sizes

All pin lengths 1/4" and shorter are neither crowned nor chamfered

MATERIALS

Cold drawn low carbon steel is used in standard Groov-Pin production. The approximate physical properties of the steel are:

Tensile strength ....110/125000 lbs/sq in.
Shearing strength ....65/80000 lbs/sq in.
Rockwell hardness ....RB 95-105

For critical applications requiring higher shearing strengths, pins of alloy steel heat treated to Rc 45-50 are available in all types and sizes. (1/32" and 3/64" dia. not heat treated unless specified.) Stainless steel 303 pins also available in all types and sizes. Monel, brass, bronze and other non-ferrous pins can be furnished to order.

FINISH

Standard carbon steel Groov-Pins are cadmium plated on diameters 1/32 and 3/64: zinc plated on 1/16 diameter and larger. Other finishes available to order. Cadmium plating is to mil. spec. QQ-P-416c, Type I, Class 3. Zinc plating is to mil. spec. QQ-Z-325b, Type I, Class 3.

HARDENING

Groov-Pins can be supplied case-hardened or thru-hardened, depending on material used.

MILITARY STANDARDS

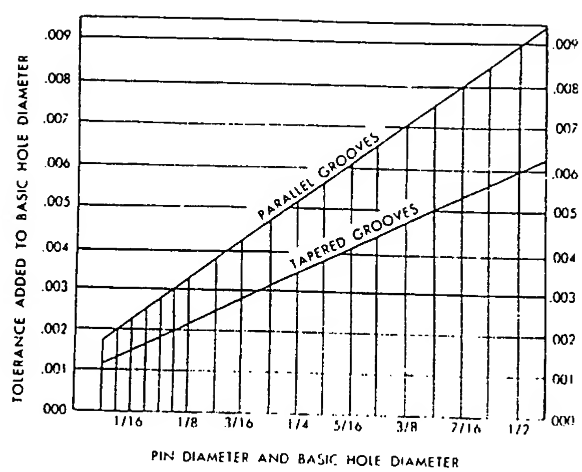
MS 35671 through MS 35679
MS 51605 and MS 51606
DOD-P-63464

DRILLED HOLE TOLERANCES

Optimum results under average conditions are obtained with a drill size equivalent to the nominal Groov-Pin or Drive Stud diameter.

The tolerances above the basic hole diameters in this chart apply generally to steel pins and pin dimensions where the length to diameter ratio is not less than 4 to 1 or more than 10 to 1 and where excellent holding power is desired. Tolerances for extremely short pins or groove lengths should be held closer if the application is critical. Conversely, where locking requirements are not severe, hole tolerances above those shown in the table may be applied for Groov-Pins.

In applications involving work material appreciably harder than the pin material, the hole edge should be chamfered to avoid shearing of the expanded pin section.



SHEAR STRENGTH

The table at the bottom of the page shows the minimum force required to shear GROOV-PINS in double shear for C-1213 (standard) steel and heat-treated alloy steel. For other materials, multiply the shear strength of C-1213 steel by the factor shown here:

Material	Factor	Shearing Strength Used in Table Below Lbs/sq in.	Average Shearing Strength by Test Lbs/sq in.	Rockwell Hardness Pins	Rockwell Hardness Blocks
C-1213	1.00	65,000	73,500	B100	B98
AISI 303	1.38	90,000	100,000	B101	B98
SAE 6150	1.95	126,600	131,000	C45-50	C58
Brass	0.62	40,400	45,500	B73	B98

SHAFT SIZE

The recommended pin diameters in relation to shaft size are the maxima for given shaft size. These should not be exceeded to avoid distortion of the shaft or fracturing, if hardened. These shaft size figures are based on C-1213 (standard) pins in double shear.

MAXIMUM TORQUE

If the torque to be transmitted is known, the proper pin size can be selected from this information. These torque figures are also based on C-1213(standard) pins in double shear and include a safety factor of 8. For materials other than C-1213 these torque figures can be multiplied by the factor.

HORSEPOWER TRANSMITTED

This is the maximum horsepower which can be transmitted by a shaft with a GROOV-PIN used to connect the shaft to another machine element, based on a safety factor of 8. The GROOV-PIN material is C-1213 (standard). For other materials multiply the horsepower shown by the factor.

TAPER PIN EQUIVALENT

These figures show the nearest size taper pin to GROOV-PINS. Because the locking effect of GROOV-PINS is substantially higher than taper pins (see page 2) the efficiency of the joint is greater.

Nominal Pin Diam. in.	Cross-Section Area sq. in.	Double Shear Strength C1213 Steel lbs.	Double Shear Strength Heat-treated Alloy Steel lbs.	Shaft Size in.	Maximum Torque in. lbs.	Hp Transmitted @ 100 rpm	Taper Pin Equivalent
1/32	.0008	104	202	3/32	.5	.001	9/0
3/64	.0017	220	430	9/64	1.9	.003	8/0
1/16	.0031	402	785	3/16	4.7	.007	7/0
5/64	.0048	624	1,215	7/32	8.5	.014	6/0
3/32	.0069	896	1,750	1/4	14.0	.022	5/0
7/64	.0094	1,222	2,380	5/16	23.8	.038	4/0
1/8	.0123	1,600	3,115	3/8	37.4	.059	3/0-00
5/32	.0192	2,494	4,860	7/16 1/2	68.2 77.8	.108 .123	0 1
3/16	.0276	3,588	6,990	9/16	126.2	.200	2
7/32	.0376	4,884	9,520	5/8 11/16	190.6 209.5	.303 .333	3 3
1/4	.0491	6,380	12,430	3/4 13/16 7/8	299.0 324.0 347.8	.475 .514 .554	4 4 4
5/16	.0767	9,970	19,420	15/16 1 1 1/16	583.8 622.5 651.6	.926 .988 1.034	5-6 5-6 5-6
3/8	.1104	11,620	27,950	1 1/8 1 3/16 1 1/4	817.2 864.1 908.6	1.29 1.37 1.44	7 7 7
7/16	.1503	15,820	38,060	1 5/16 1 3/8 1 7/16	1,300 1,361 1,423	2.06 2.16 2.26	7 7 7
1/2	.1963	20,600	49,700	1 1/2	1,930	3.06	8

☐ Gray areas indicate non stocked sizes

INSERTION FORCES

Tapered Grooves

Groove Length	Insertion Force, lbs. (approx.) According to Pin Diameter													
In.	3/64	1/16	5/64	3/32	7/64	1/8	5/32	3/16	7/32	1/4	5/16	3/8	7/16	1/2
1/4	40	50	65	80	110	140	210	290	390	490				
1/2	85	110	140	180	230	280	410	560	730	920	1340	1800		
3/4		160	200	270	340	410	600	810	1050	1320	1900	2560	3260	4000
1		205	280	360	450	560	800	1060	1370	1700	2460	3300	4200	5100
1 1/2							1150	1510	1900	2340	3340	4460	5600	6700
2							1500	1960	2440	2960	4220	5560	6900	8300
2 1/2											5270	6960	8600	10300
3											6300	8340	10300	12400

These forces are average obtained from test data and may be used as a guide for engineering and in the selection of installation equipment

☐ Gray areas indicate non stocked sizes

Parallel Grooves

Insertion Force Per Inch of Groove Length

Pin Diameter	1/16	5/64	3/32	7/64	1/8	5/32	3/16	7/32	1/4	5/16	3/8	7/16	1/2
Lbs.	500	600	710	820	930	1200	1500	1800	2150	2950	3840	4750	5700

☐ Gray areas indicate non stocked sizes

Insertion and Removal Forces

The curves in this chart indicate variations in insertion and removal forces resulting from progressively larger hole tolerances.

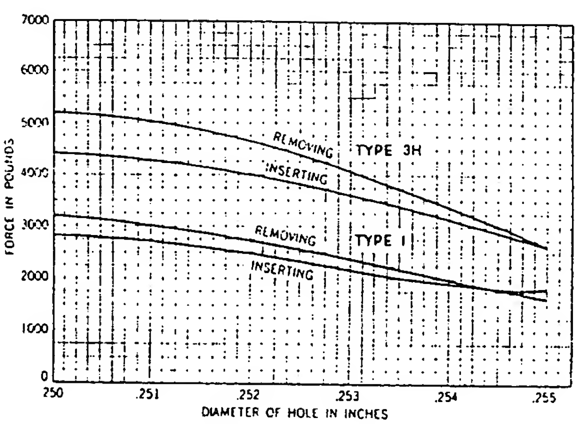
Standard Groov-Pins of 1213 steel Rb 88-100 were inserted in 1020 Rb 94.

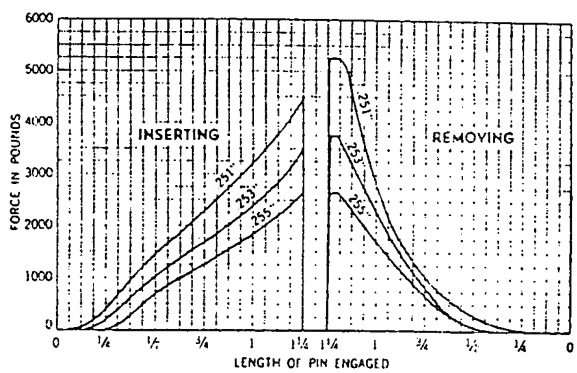
Although the recommended hole tolerance for ¼" diameter Groov-Pins is .0035, test results indicate a more liberal hole tolerance may be specified, resulting in relatively small loss of holding power.

Insertion and Removal Work Performed

The areas below the curves in this chart indicate the work performed during insertion and removal of this Groov-Pin in various hole sizes.

The effective length of pin engagement is greater and removal forces are higher than insertion forces with narrower hole tolerances.





STOCK PIN LENGTHS AND WEIGHT IN LBS. PER 1000 PINS

Pin Length In.	Diameter, in. 1/32	3/64	1/16	5/64	3/32	7/64	1/8	5/32	3/16	7/32	1/4	5/16	3/8	7/16	1/2
1/8	.027	.061	.109												
3/16	.040	.091	.163												
1/4	.054	.122	.222	.350	.506	.695	.914								
5/16	.067	.153	.276	.436	.630	.862	1.133								
3/8	.081	.183	.330	.520	.751	1.027	1.348	2.13	3.07						
7/16	.094	.214	.385	.605	.874	1.195	1.567								
1/2	.108	.244	.439	.689	.995	1.360	1.782	2.80	4.04	5.55	7.31				
9/16		.274	.492	.773	1.117	1.525	1.997								
5/8		.305	.547	.858	1.238	1.690	2.213	3.45	5.02	6.88	9.03	14.3			
3/4			.655	1.028	1.484	2.025	2.650	4.17	6.00	8.21	10.8	17.0	24.7		
7/8			.764	1.198	1.729	2.357	3.084	4.84	6.98	9.55	12.5	19.7	28.6	39.2	
1			.873	1.367	1.973	2.690	3.518	5.52	7.96	10.8	14.2	22.5	32.5	44.6	58.5
1 1/4					2.462	3.355	4.387	6.89	9.91	13.5	17.7	27.8	40.3	55.2	72.4
1 1/2								8.24	11.8	16.2	21.2	33.3	48.1	65.8	86.3
1 3/4								9.60	13.8	18.8	24.6	38.7	55.9	76.5	100.2
2								10.95	15.8	21.5	28.1	44.1	63.7	87.1	114.0
2 1/4									17.7	24.1	31.6	49.6	71.6	97.7	128.0
2 1/2										26.8	35.0	55.0	79.4	108.4	141.9
2 3/4										29.5	38.5	60.4	87.2	119.0	155.8
3										32.2	42.0	65.8	95.0	129.6	169.6
3 1/4											45.5	71.3	102.8	140.3	183.5
3 1/2												76.7	110.6	150.9	197.4
3 3/4													118.4	161.6	211.3
4													126.3	172.2	225.2
4 1/4													134.0	182.8	239.0
4 1/2														193.5	253.0

☐ Gray areas indicate non stocked sizes

To obtain weights of other metals, multiply table values by factor given below:

Free-cutting Brass 1.084
Phosphor and Commercial Bronze 1.13
Chrome Vanadium .... .995

Stainless Steel 1.01
Monel Metal 1.12
Aluminum .... .37

PART NUMBERING SYSTEM

Our part numbering system permits ordering of any commonly used Type, size, material, and finish of Groov-Pins by code. Example: Groove-Pin Type 3H, 1/8" x 1 1/4" steel, zinc plated

GP 3H — 125 x 1250 — 14

Type — Dia — Length — Material — Plating

Diameter and length are indicated in thousandths. Material and finish are indicated by the following codes:

Material

1 Standard: Cold Drawn Low Carbon Steel
2 Aluminum
3 Brass
4 Monel "R"
5 Stainless Steel 303
6 Bronze
*7 High Strength Alloy Steel
8 Beryllium Copper

Finish

0 · Plain
1 Phosphate
2 Cadmium, QQ-P-416c, Type I, Class 3
3 Brass
4 · Zinc, QQ-Z-325b, Type I, Class 3
5 Nickel
6 Black Oxide
7 Zinc Chromate, QQ-Z-325b, Type II, Class 3
8 Cadmium Chromate, QQ-P-416c, Type II, Class 3
9 Special

*1/32" and 3/64" dia. pins are not heat-treated. 1/16" dia and larger are heat-treated to Rc 45-50 unless otherwise specified.
Casehardening: Indicated by the suffix "H"
Example: Groov-Pin type 1, 3/32" x 1/2" steel, zinc plated, case hardened, GP1-093 x 0500-14H
Note: Other materials, finishes, and heat-treatments should be specified separately.
Standard carbon steel GROOV-PINS are cadmium plated on diameters 1/32 and 3/64 zinc plated on 1/16 diameter and larger

COMMERCIAL STRAIGHT PINS

are available in all sizes shown in the above table. Pin ends are chamfered in diameters from 1/16" up. Pin ends are straight sheared in diameters below 1/16"

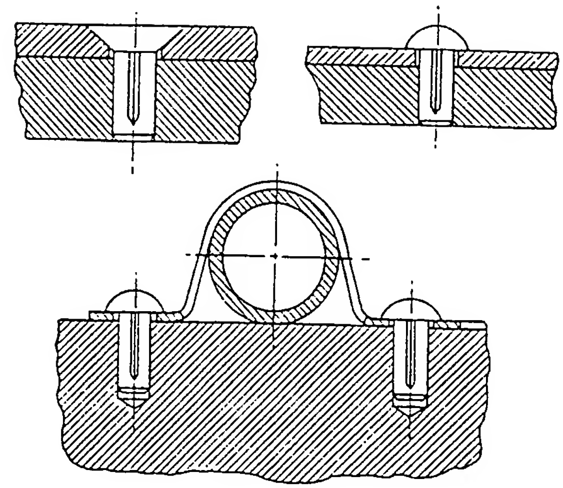
DRIVE STUDS

ROUND HEAD STYLE

The grooved Drive Stud embodies the same principle applied in GROOV-PINS and is used wherever a headed fastening element is required to replace screws, rivets, etc. It has three parallel grooves extending over the length of the shank and a short pilot for positioning.

APPLICATIONS

Because Drive Studs can be applied much more rapidly than threaded fasteners, new uses are continually being found and labor costs reduced. Fastening cover plates, name plates, decorative escutcheons and clamping conduit or pipe to structural materials are a few examples of where Drive Studs are being used.



MATERIAL

The standard material is cold drawn low carbon steel.

FINISH

The standard finish is zinc plating to mil. spec. QQ-Z-325b, Type I, Class 3. Other finishes are available to order.

OTHER HEAD STYLES

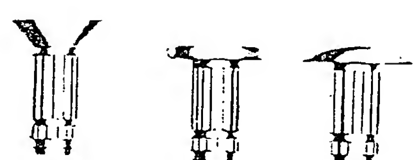
Head styles other than round, groove patterns to fit special needs and special materials such as brass, stainless steel or monel metal can be furnished subject to minimum quantity charges.

Our engineers will gladly recommend the type of fastener best suited to your needs if you send us data, drawings or sample assemblies.

OFFSET RIBBED DRIVE STUDS

This hardened stud has been designed for application in any material subject to plastic deformation, such as cold and hot rolled steel, zinc die castings, aluminum or magnesium sand or die castings, and is **particularly recommended for secure fastening where extreme vibration is encountered.**

The two sets of longitudinal ribs are offset one from the other by one half pitch. The lower set of ribs, first engaged during insertion, forces the hole wall material into the valleys between ribs. The flow of displaced material is then deflected to follow the offset path when the upper ribbed section engages and the stud is securely locked in the work material. The material is steel, case hardened and plated.



DIMENSIONS FOR GROOVED DRIVE STUDS — ROUND HEAD

Stud Size Number	0	2	4	6	7	8	10	12	14	16
Nominal Shank Diameter	.067	.086	.104	.120	.136	.144	.161	.196	.221	.250
Recommended Drill Size	51	44	37	31	29	27	20	9	2	1/4"
Head Dia., min.	.120	.146	.193	.240	.287	.287	.334	.382	.429	.443
max.	.130	.162	.211	.260	.309	.309	.359	.408	.457	.472
Head Height, min.	.040	.059	.075	.091	.107	.107	.124	.140	.156	.161
max.	.050	.070	.086	.103	.119	.119	.136	.152	.169	.174

Expanded Diameter as measured with ring gauge

Stud Length under head		0	2	4	6	7	8	10	12	14	16
	1/8	.074	.096								
	3/16	.074	.096	.115							
	1/4	.074	.095	.113	.132						
	5/16			.113	.130	.147					
	3/8				.130	.147	.155	.173			
	1/2					.144	.153	.171	.206	.234	.263
	5/8						.153	.171	.204	.232	
	3/4								.204	.232	

Tolerances: length ±.010; expanded diameter ±.002; nominal diameter +.000, −.002.

WEIGHTS FOR DRIVE STUDS

Approximate weight (lbs.) per 1,000 pieces

Stud Size Number		0	2	4	6	7	8	10	12	14	16
Stud Length	1/8	.230	.432								
	3/16	.310	.570	.946							
	1/4	.370	.710	1.15	1.68						
	5/16			1.35	1.95	2.61					
	3/8				2.21	2.95	3.21	4.39			
	1/2					3.63	3.97	5.34	7.70	9.90	14.50
	5/8						4.74	6.30	9.11	11.70	
	3/4								10.55	13.15	

DIMENSIONS FOR OFFSET RIBBED DRIVE STUDS

Stud Size Number	0	2	4	6	7	8	10	12	14	16
Nominal Shank Diameter	.067	.086	.104	.120	.136	.144	.161	.196	.221	.250
Recommended Drill Size	51	44	37	31	29	27	20	9	2	1/4"
Min. Recom. Depth of Engagement in Blind Holes	1/8	1/8	1/8	1/8	5/32	5/32	5/32	7/32	7/32	7/32
Min. Recom. Engagement in Through Holes	1/16	1/16	5/64	5/64	3/32	3/32	7/64	7/64	1/8	1/8
Stud Lengths Available	3/16, 1/4, 5/16				1/4, 5/16, 3/8, 1/2			5/16, 3/8, 1/2		

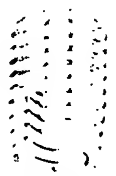
For maximum holding power in through or blind holes, both ribbed sections should be engaged in the work material

Tolerances: shank length ±.010
nominal shank diameter +.000, −.002

More precision products from the fastener specialists

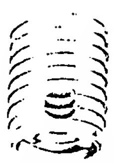
TAP-LOK®
Self-Tapping, Self-Locking Inserts

Here's another Groov-Pin advance in fastener technology. Tap-Lok taps its own thread. Locks securely in one easy operation. Creates strong, permanent threads. Tap-Loks represent a low-cost, fast-installing way to put permanent, load-bearing threads in plastics, woods and metals ranging from aluminum to mild steel. Available in inch and metric sizes.

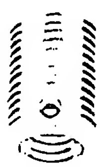


Slotted

This insert permits application in a wide choice of hole sizes. Ideal for softer aluminums, zinc die castings, sand castings and plastics.



TH(thin wall)

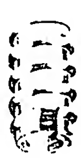


H(hole)

For high strength materials that are tough to tap. Used in wrought aluminum, magnesium, tough aluminum alloy castings, mild steel. Both series comply with MS35914.

N (Nylok)

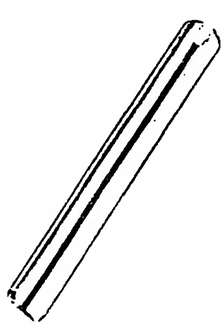
Nylon pellet locks mating fastener, prevents loosening under severe conditions. Resists heat, cold, moisture, most commercial solvents. Designed to satisfy MIL-N-25027 (ASG) requirements; complies with MS35914.



W (brass)

WH (Zamak)

Used in hard or soft woods and wood composites. Coarse pitch of external threads provides maximum strength, eliminates splitting. Ideal for most wood assemblies.



SPRING PINS

Tubular slotted spring pins for many assembly operations. Available in plain or plated carbon spring steel, or in corrosion-resistant stainless.
Provide fast assembly and solid locking action.

INSERTS FOR PLASTICS
Threaded, post molded inserts for thermoplastics and thermosets.

Our extensive line for all your present or future applications. All offer high pull-out strength, strong torque out resistance, and fast installation. These standard brass inserts provide one-for-one exact replacements for most popular types, or we can produce a special one to meet your exact production requirements. Either way, pricing and delivery are competitive.

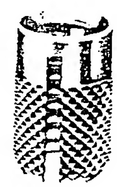
Vibra-Sert® I

Vibra-Sert® II

For ultrasonic or heat installation in thermoplastics, laminates and other low strength materials. Features like self-locating, self-aligning pilot gives positive seating and anchorage, or knurled flanges for optimum surface appearance.

Tap-Lok® C series

Self-tapping and locking with coarse threads for easy installation in thermoplastics or thermosets. Maximum holding power even in brittle plastics. Available in case-hardened steel, when required.

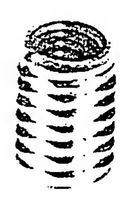


Banc-Sert®

Push-in installation for thermosets and hard plastics. Sharp knurls for holding power against torque-out, pull-out and vibration.

Barb-Sert®

Push-in or ultrasonic installation with low force yet real holding power in plastics, laminates or other low strength materials. Top deflection ring for mar-free surface.



Form-Lok®

Strong threaded connections in metal and plastic, without tapping

Form-Lok is designed with wave form external threads which roll their way through the base material without cutting. The result is no chips to clean. Form-Lok won't back out, provides strong, reusable threads for high-volume manufacturing.

GROOV-PIN CORP.

1125 Hendricks Causeway · Ridgefield, New Jersey 07657 (201) 945-6780

PRINTED IN U.S.A
7028F